

## CLAIMS

What is claimed is:

1. A laser waveguide for use in waveguide lasers comprising:  
an upper electrode, the upper electrode having a first surface;  
and  
a lower electrode, the lower electrode having a second surface,  
where the first surface and second surface are separated by at least one sidewall, where the first surface and the second surface face each other, portions of which are not completely covered by the at least one sidewall, and where the first surface, second surface, and the at least one sidewall form the laser waveguide.
2. The laser waveguide according to claim 1, wherein the at least one sidewall is more than one sidewall.
3. The laser waveguide according to claim 2, wherein the more than one sidewall are sectional sidewalls.
4. The laser waveguide according to claim 3, wherein the sectional sidewalls are separated by sectional gaps.
5. The laser waveguide according to claim 1, wherein the at least one sidewall is made of ceramic.

6. The laser waveguide according to claim 1, wherein the at least one sidewall is made of BeO.
7. The laser waveguide according to claim 1, wherein the at least one sidewall is made of AlN.
8. The laser waveguide according to claim 1, wherein the electrodes are made of metal.
9. The laser waveguide according to claim 3, wherein the sectional sidewalls are under 200.0 nm in length.
10. The laser waveguide according to claim 1, wherein the upper electrode is shaped to form first protrusion(s) that decrease the distance between the first protrusion(s) and the lower electrode.
11. The laser waveguide according to claim 1, wherein the lower electrode is shaped to form first protrusion(s) that decrease the distance between the first protrusion(s) and the upper electrode.
12. The laser waveguide according to claim 10, wherein the lower electrode is shaped to form second protrusion(s) that decrease the distance between the second protrusion(s) and the upper electrode.

13. A waveguide laser comprising:

a laser waveguide, wherein the laser waveguide is formed by electrodes and at least one sidewall such that no surface of the electrodes forming the boundary of the waveguide is completely covered by the at least one sidewall;

an oscillating electromagnetic field, wherein the electromagnetic field is produced by an oscillating current supplied to the electrodes such that the electromagnetic field is produced in the laser waveguide; and

a lasing material placed in the waveguide, wherein the electromagnetic field produces stimulated emission of electromagnetic radiation from the lasing material.

14. The waveguide laser according to claim 13, further comprising:

a RF power supply, where the RF power supply powers the oscillating electromagnetic field; and

a microprocessor; wherein the microprocessor operates at a frequency higher than the frequency of the oscillating electromagnetic field and controls operations of the RF power supply.

15. The waveguide laser according to claim 13, wherein the at least one side wall is more than one sidewall.

16. The waveguide laser according to claim 15, wherein the more than one sidewall are sectional sidewalls.

17. The waveguide laser according to claim 16, wherein the sectional sidewalls are separated by sectional gaps.

18. The waveguide laser according to claim 13, wherein the at least one sidewall is made of ceramic.

19. The waveguide laser according to claim 13, wherein the at least one sidewall is made of BeO.

20. The waveguide laser according to claim 13, wherein the at least one sidewall is made of AlN.

21. The waveguide laser according to claim 13, wherein the electrodes are made of metal.

22. The waveguide laser according to claim 17, wherein the sectional sidewalls are under 200.0 mm in length.

23. The waveguide laser according to claim 13, wherein the upper electrode is shaped to form first protrusion(s) that decrease the distance between the first protrusion(s) and the lower electrode.

24. The waveguide laser according to claim 13, wherein the lower electrode is shaped to form first protrusion(s) that decrease the distance between the first protrusion(s) and the upper electrode.

25. The waveguide laser according to claim 23, wherein the lower electrode is shaped to form second protrusion(s) that decrease the distance between the second protrusion(s) and the upper electrode.

26. The waveguide laser according to claim 13, wherein the lasing material is CO<sub>2</sub>.

27. The waveguide laser according to claim 13, wherein the lasing material is a mixture of CO<sub>2</sub>.

28. A waveguide laser comprising:

a laser waveguide, wherein the laser waveguide is formed by electrodes and at least one sidewall such that no surface of the electrodes forming the boundary of the waveguide is completely covered by the at least one sidewall, where the sidewall has first and second surfaces forming a portion of the laser waveguide, and where the portion varies in distance from the first surface to the second surface along the length of the waveguide;

a housing, where the housing encompasses the laser waveguide and is pressurized to sub-atmospheric pressures;

an oscillating electromagnetic field, wherein the electromagnetic field is produced by an oscillating current supplied to the electrodes such that the electromagnetic field is produced in the laser waveguide; and

a lasing material placed in the waveguide, wherein the electromagnetic field produces stimulated emission of electromagnetic radiation from the lasing material.

29. The waveguide laser according to claim 28, further comprising:

a RF power supply, where the RF power supply powers the oscillating electromagnetic field; and

a microprocessor; wherein the microprocessor operates at a frequency higher than the frequency of the oscillating electromagnetic field and controls operations of the RF power supply.

30. The waveguide laser of claim 28, wherein the housing is formed from the at least one sidewall.

31. The waveguide laser of claim 28, wherein the housing is formed from at least one of the electrodes.

32. The waveguide laser of claim 28, wherein the distance between centerlines of the cross-sections of the electrodes varies along the length of the waveguide.

33. The waveguide laser of claim 28, wherein the distance between the first and second surfaces varies along the length of the waveguide.

34. A method of forming a laser waveguide comprising:
- placing an upper electrode, the upper electrode having a first surface with a protrusion;
  - positioning at least one sidewall on the first surface, such that the at least one sidewall does not completely cover the first surface; and
  - positioning a lower electrode on the at least one sidewall, the lower electrode having a second surface, where the at least one sidewall does not completely cover the second surface, and where the placement of the upper electrode, positioning of the lower electrode and the at least one sidewall, forms a laser waveguide having a compact structure.
35. The method of claim 34, further comprising:
- forming the at least one sidewall, where the forming step is comprised of:
    - pressing at least one ceramic piece into a desired shape; and
    - grinding the at least one ceramic piece to a first tolerance.
36. The method of claim 34, further comprising:
- forming the lower electrode, where the forming step is comprised of:
    - milling the lower electrode to a second tolerance.
37. The method of claim 34, further comprising:
- forming the upper electrode, where the forming step is comprised of:
    - milling the upper electrode to a third tolerance.